Pancoast

# INTRODUCTORY LECTURE

TO THE

# COURSE OF ANATOMY,

DELIVERED IN

## JEFFERSON MEDICAL COLLEGE,

OCTOBER 19th, 1849.

BY

JOSEPH PANCOAST, M.D.

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Published by the Class.

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# CORRESPONDENCE.

JEFFERSON MEDICAL COLLEGE, October 24th, 1849.

PROFESSOR JOSEPH PANCOAST:

*Dear Sir*,—It is with the greatest pleasure that we, a committee appointed by the Class, fulfil their instructions in respectfully soliciting for publication a copy of your Introductory, delivered on the 19th of October.

Yours, very respectfully,

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PHILADELPHIA, November 6th, 1849.

*Gentlemen*,—I had the honour, some days since, to receive from you, on behalf of the class, a polite request that I should furnish you with a copy of my lecture introductory to the present course, for the purpose of publication.

I have withheld my assent till this late period, in hopes you would have succeeded, generally, in a similar application to my colleagues, whose lectures were, I believe, better worthy of this mark of your consideration.

I shall, however, cheerfully comply with your wishes, and am ready to place the copy in the hands of the printer at any time you may suggest.

Be pleased, gentlemen, to accept for yourselves, and the class which you represent, the assurance of my great regard and attachment.

JOSEPH PANCOAST.

To Messrs. BAER, and others,
*Committee of the Class.*

# INTRODUCTORY.

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GENTLEMEN,—

You have but just now listened to a lively and instructive lecture from my friend and colleague the Professor of Surgery, and I trust you have been so well entertained and put in so good a humour as to listen at this late hour of the evening, with patience and with kindness, to what I have now the honour to address to you.

The theme upon which it is my duty to discourse to you to-night, and to dilate upon throughout this lecture-term, is a right noble one. It is no less than that of making known to you the admirable construction of the various parts of the machinery composing the body of man—of man, that great creation, who is without question lord paramount over all the beings of the earth, which he governs like a king by his own royal will; who has measured and numbered the stars, circumscribed the earth and the sea, and called down the lightning of heaven to transmit his behests at the impulse of a finger and with the rapidity of thought. The importance of such a subject, it seems impossible to overrate, however much by the ignorant and the prejudiced it may be misunderstood. And I cannot but feel that the free privilege afforded us here, of being permitted to bring into the precincts of this scientific temple, the mortal remains of those who have but lately lived, and breathed, and thought, and acted, with the object of unravelling the structure for your information and improvement, renders our vocation peculiarly grave and important.

In standing up thus solemnly before you, at the portals of an

important chamber of science, into which I invite you to enter with the respectful and serious earnestness of men, aware of what presence you are in, for the purpose of studying the instruments of vital motion in man, that you may prevent it from being suspended,—to associate on intimate terms with death, that you may preserve life—I cannot, I repeat, but feel that my position is one of great responsibility; for it is that of portraying to you the science, not as it was made by the work of any one man, or of any single age or generation, but as it has come down to us in its present almost perfect condition,—the essence of the wisdom of the many noble spirits long since passed away, who toiled and toiled for its advancement, "from night till morn, from morn till dewy eve." It has seemed to me, therefore, that I could scarcely do better, in the brief space of time allotted me here, than to take a hasty survey of the varying progress, now rapid and now slow, which the science has made from its early origin down to the present period.

In attempting this historical sketch, how far will it be necessary for us to go back on the stream of time, for a commencement?

To the period of the flood? No. Though men who could build cities, and who waged wars and sieges, it is not unreasonable to suppose, must have possessed some crude knowledge of the human structure.

Shall we commence then with the days of Assyrian, Egyptian, Grecian, Roman, or Mahommedan greatness?

Of the Assyrians we know nothing, save that they were a great, ingenious, and polished people, so thoroughly annihilated by barbaric irruption, that the very seat of all their greatness had become unknown, till its recent disentombment, by a solitary Englishman, on the banks of the once populous Tigris.

To the old Egyptians, notwithstanding their reputed learning, we can turn with little better success; for this people held the dissection of human bodies in such utter abhorrence, as to pursue with stones those who, in embalming the dead, extracted the viscera by an incision through the walls of the abdomen.

Shall we, then, revert to ancient Greece, that mother of arts and arms? There too, we find, that the superstitions of a false

but influential religion, by requiring the speedy burning or burying of the bodies of the dead, stood in direct opposition to the practice of human anatomy, without which, we know full well, no available knowledge of the human body could possibly be acquired. Some of the towering spirits of that nation, however, Democritus, Hippocrates, and Aristotle, striving, against this weight of prejudice, to extend the bounds of human knowledge, were enabled by the careful dissection of animals nearest man in their organization, by the incidental survey of bones accidentally disinterred, from wounds made in battle, and possibly also by an occasional secret dissection of the human frame, to throw the first strong gleam of light, but yet, merely a gleam, upon the mysterious workings of the human frame.

Shall we go to the seven-hilled city, that central seat of Roman greatness, from whence a fettered world was swayed with a political influence that has never yet been equalled? Though the admitted nursery of many of the arts and sciences, and the home of poetry and eloquence, there was not, withal, in Rome, sufficient general enlightenment to perceive the importance of, and to promote, the cultivation of that particular science—our science, in which every citizen had the deepest possible personal interest. To their great dishonour, the Romans drove away, with disgust and abhorrence, Galen, the sage of Pergamos, a master in the art of eloquence, and a great teacher of the wisdom of the time, who had wished to instruct them in the scanty knowledge of the human body, which, after much toil and journeying, he had gathered in the school of the then modern Alexandria.

In the more than Cimmerian darkness that succeeded the overthrow of the Roman empire, the small amount of knowledge of human anatomy with which the world had been blessed took refuge beneath the Koran, in the city of the renowned Haroun Al Raschîd, and in the seminaries of the chivalric and intelligent Saracenic conquerors of Spain. But, to this era of Mahommedan glory we need not refer; for though the followers of the Arabian prophet might preserve, they were not able to improve the science, inasmuch as human dissection was interdicted to them by the mandates of their narrow religion. It is, in truth, useless, as

regards the purpose we have in question, to go back beyond the period at which dissection, from the general increase of intelligence, and the better appreciation of its importance to man, was shorn of its horrors by being rendered a legitimate pursuit.

This will take us back to a period which, though in the world's history comparatively recent, should to an American be one of most peculiar interest. I allude to that epoch at which one of the most renowned of men, the son of a poor wool-comber in Genoa, formed the grand conception of the existence of an unknown hemisphere on the opposite side of the globe, and at the risk of being deemed mad or foolish, had the genius to plan and the perseverance to accomplish its discovery. With vessels now deemed unfit to make a coasting voyage on the same shores, he ploughed his bold path across an unknown sea, and revealed to astonished Europe men, animals, plants, such as no civilized eye yet had seen; mountains and rivers of proportions almost incredible; and, in fine, another earth, which was from that moment to constitute a new centre to the movements of the human race, that was first to disturb, then to convulse, and finally, it may be believed, to control the operations of the old world. It is difficult for us, at this distant period of time, to form a proper idea of the astounding impetus, thus immediately impressed upon the minds of men, by the discovery of Columbus. But history shows us that the sudden spring thus given to thought and enterprise by the opening of a new field for observation in every department of life, burst quickly the trammels that the scholastic absurdities of the times had fixed on Europe, and allowed every ingenious mind to adventure broadly into the great domain of nature, in search of new developments in art and science.

Prior to this period of the fifteenth century, what was the state of anatomical science? Did men possess much better knowledge of the lesser world of man's organism, than of the macrocosm of the earth, which but few were willing to believe round, most supposing it extended out in a vast plane, at the extremes of which the sun rose and set, agreeably to the notions of the ancient poets, in a boundless sea? There was but one man in the whole nineteenth century who could pride himself on having performed as many as fourteen dissections of the human frame, and

that man was Montagnani, a professor of Padua, in Italy. A great boast was this for that period; for as yet the minds of men were not sufficiently freed from the shackles of ignorance and prejudice, to allow anatomists to apply freely to the only true source of anatomical knowledge, notwithstanding the business of dissection had been legitimatised in the previous century by Frederick II., of Sicily.

At this period, in addition to the general outlines of muscles and organs, anatomists became for the first time acquainted with the existence of the small bones of the ear, with the prostate gland, found out that there were three lobes to the liver, and that the ventricular septum of the human heart was not pierced, as it is in the amphibia. Still they had not as yet learned to be so self-reliant as to trust to the testimony of their own senses, when it conflicted with the blind reverence so long felt for the doctrines of Galen; and we find Du Bois, one of the intelligent anatomical discoverers of this period, justifying the errors of their great oracle, by supposing that the human body had degenerated since the period of Galen, who, following Aristotle, had described man as being physically in most respects like the monkey, save that he had worn off his tail by sitting upon something like our hard-bottomed chairs.

The sixteenth century opened brightly, forming a new era in anatomical science. Fallopius, Eustachius, Vesalius, and Varolius, men whose names are yet preserved with scientific respect, maintained, with final success, against the bad faith and scholastic pride of the Galenists, the necessity of consulting the human body itself, as the only reliable source of information for the elucidation of its structure, functions, and diseases. This opinion once established, there was fairly opened an immense field for observation and discovery; and human anatomy, as a true and positive science, may be fairly said to date its origin from this epoch. Then was first given an intelligible description of the brain and nerves, and human eye; then was first discovered the fallopian ducts, the placenta, the Eustachian tube, the ileo-colic valve, and the muscular fibres of the stomach. The brilliant discoveries of these Italian anatomists, as portrayed in the beautiful plates of Eustachius, spread a general taste for the science

throughout Europe, and led to the institution of special chairs for this subject, which had previously been taught by the professors of theoretic medicine. At the close of the sixteenth, and the beginning of the seventeenth century, Italy, which had been the genial nursery of the arts and sciences, lost the supremacy which she had so long held in our pursuit, first to the Dutch, and then to the English and French anatomists. The next great onward movement in the science was the discovery of the circulation of the blood, by Harvey, in 1602, and that of the absorbent system, by Rudbeck and Asellius, which followed shortly after. This discovery of the circulation by the English anatomist, the fruit of seventeen years' most anxious and intelligent labour, struck the world with an electric shock of excitement, and his doctrines finally triumphing over all the obstacles opposed to their adoption by ignorance and prejudice, so revolutionized medical opinions as to make it necessary to construct anew the departments of physiology, surgery, and medicine.

Then for the first time was attached much importance to the study of the arteries, which had been neglected for the veins, as these were deemed more essential and noble parts of the organism.

The great revolution that speedily followed the discovery of Harvey, was urged on by many able men, whose names and merits are imperishably inscribed on the rolls of fame.

In furtherance of this important work, now too came the invention of the microscope; and microscopical anatomy soon grew into favour, and was cultivated with great success by Malpighi, Ruysch, Swammerdam, and Lewenhoeck. Vieussens, Willis, Ridley, Cowper, Valsalva, Bellini, Lower, Bruner, Glisson, and Wharton published admirable treatises for the time, on the different parts of the human body. Now, too, the immortal Morgagni laid the foundation of pathological anatomy, and a little in his rear followed the great Albinus, who consecrated seventy years of a most active life to practical anatomy, and enriched the science with works of which we scarcely know whether most to admire the scrupulous exactness of the descriptions, or the admirable finish of the drawings.

Human anatomy was thus completely established in its legiti-

mate rights, as an important and indispensable part of the great domain of medicine, and indeed was now pushed so far in advance of other pursuits, that it was believed there was little of any importance left for succeeding ages to discover. Supineness and lethargy followed, as a natural result, on so impotent a conclusion; and, as a consequence, many men of that period, capable of better things, lived and died, content merely with acquiring for themselves what had been already inculcated, without seeking to extend the boundaries of professional knowledge, which they might so readily have done, much to their own glory, the honour of their nation, and the advantage of their race.

Think, my young friends, of the effect of this enervating opinion on the march of science, and let the memory of it excite one and all of you to active, unflinching exertion, in order to stimulate yourselves in the earnest endeavour to add something in the way of discovery or application to our store of knowledge, that some future teacher of anatomy may from this place, with a proud and swelling heart, boast of as the production of his native land. For even now, at the present advanced state of all the sciences, we may be just on the boundaries of some grand improvements, like the anatomists of the period just referred to, who were not clear-sighted enough to discover the vast amount of scientific riches that comparative anatomy presented as an accessory means of elucidation of human structure and the exposition of the general laws of life, regarding it merely as a part of the domain of natural science, of little utility save in regard to the classification of animals. A Hunter and Hewson, and the hundred others which followed in the same path of exploration, opened with great glory to themselves these rich mines of inexhaustible wealth.

But even by this class of observers, the organs of the body, examined as yet only in gross, mainly excited attention in their relation to physiology and surgical operations.

It was reserved for the genius of Bichat, taking the road opened to him by Pinel and Haller, to resolve the whole body into separate elementary tissues, and thus to create the all-important department of general anatomy. In the view of Bichat, the tissues, such as the cellular, the nervous, and the

vascular, were the simplest or individual parts—the woof, with which the various organs of the body were woven or built up—so many different materials, endowed with particular vital forces, upon which the actions of the organs depended, nearly as the play of a machine is the consequence of the elasticity of the spring which puts it into motion. These tissues were to Bichat what carbon, oxygen, hydrogen, and nitrogen are to the chemist in inorganic matters.

This doctrine of Bichat led to vast improvements in the practice both of medicine and surgery, not only effecting a new revolution in nosology, but conferring an inestimable benefit, by bringing the science of physiology, healthy and diseased, to take its proper place as the grand interpreter in the path of practice. It formed the basis of the education which most practitioners, now in the meridian of their days, received in their youth. It raised the study of the human form and the vocation of the anatomist to the highest place in the estimation of both the profession and the public; for such is the direct connexion between anatomical knowledge and the practice of medicine and surgery, that a close observer cannot fail to see, throughout all its stages of history, that it has been to anatomical discoverers that we owe the great improvements that have taken place in all the practical branches.

It took nearly one generation to work out to full fruition the wide harvest opened by the genius of Bichat. The close of that generation brings us down to our time—to yours I may say, for the greatest advance of all has been made since most of you have been of an age to become intelligent observers. To the improvement and the employment of the microscope, and the entertainment of grander and juster views in respect to the importance of comparative anatomy, this last advance is mainly due. The microscopists, not satisfied with Bichat's tests of the identity of physiological function, wished to determine, by the aid of high magnifying powers, the exact fibres and granules of which the separate tissues were composed, and thus do for the individual tissues what Bichat had done for the body at large,—that is, to resolve the tissues into their simple elements, and to ascertain exactly the character, and measure the dimensions of the minutest fibres, tubes, and cells, that the microscope could

bring into view. Another great improvement followed directly, as the result of their exertions. A distinction of structure has been ascertained between the voluntary and involuntary muscular fibres; the ducts of different secreting glands have been ascertained to be tubes, commencing by blind extremities, and always maintaining a diameter much greater than the capillary vessels; the analogy between the skin and mucous membranes has been more clearly determined, since the epithelium has been shown extending over the whole tract of the latter, though modified in certain portions, and clothed with microscopic cilia, which by an instinctive fanning movement, not checked immediately even by death, waft along the fluids that cover them through narrow passages like the nostrils, the bronchia, and fallopian tubes; and, more than all, in determining the character of the fluids of the body, which had not received the attention due to them from Bichat, fixing the globular character of certain of them, and proving in fact that some of them differed mainly from the solids in being found in a less condensed state, and showing that the solids are built up by cells, and that the blastema, or elementary source of these cells, is to be found in the great fluid of the body, the blood.

You will perceive, by this sketch, the interesting course which the science has run in its progress to its present improved condition. First the organs at large excited attention, then came the study of the organs in relation to physiology and surgery, then they were unravelled by Bichat into the separate tissues, and finally these tissues have been shown, to have their elementary organization, in all animals, in cells, which are destined to undergo various degrees of development. Having thus traced up the march of science to the present period, it is fit we should turn to glance at its existing condition. The characteristic features of its advancement will be found in the general application of comparative anatomy to the elucidation of the structure and function of the human organs, and the application of the cell theory to their laws of development. While in these respects a wide field is opened for improvement and discovery, we shall see as we progress, that there is attendant on the one hand, a risk that we may generalize so much, as to impair the value of the

science in reference to its application to man's own structure, and on the other, be led by the microscope, so far in the study of atoms, as to become infinitesimal and abstruse in our deductions.

The human frame is now considered the embodiment of the forms and the exhibiter of the functions, found in all that immense series of living beings that stretch from man downwards to the minutest monad, which is but an isolated living vesicle, and therein a representative of one of the cell-germs in the human tissues.

The scale in animals begins not where plants terminate. There is a great hiatus between them. The most perfect production of a plant is a granular substance, such as we see in the pollen-dust of a flower. The lowest grade in animal life is a granule also, but it is a granule made hollow, metamorphosed into a minute bladder or vesicle, capable of feeding and sustaining itself, and giving rise to a series of individual actions. Now the ultimate composition of almost all the living tissues, as shown by the microscope, is but an accumulation of almost incredibly minute vesicles or nucleated cells. And this is the composition of the highest of all the tissues of the human body, that of the nervous system itself; and a knowledge of this carried out in physiology alone enables us to understand the separate action of individual parts of the nervous system, as explained by the system of Dr. Marshall Hall.

The voluntary muscles are composed of quadrangular cells, arranged in regular series; and muscular action in all probability consists in an approximation and change of form of these individual cells. To support the muscles and nerves, and serve as levers to the former, we have a hard, unyielding system, which we denominate bone. And even the bones, when examined under the microscope, are found to have been developed in cells, but cells greatly metamorphosed by being filled in their interior, and so encrusted on the outside with earthy salts, as to maintain a fixed and steady form. Now these three systems alone suffice to give us the general idea of a high animal. They are therefore the highest structures. They make the animal circle complete. We have the bones to support the body, whether in the shape of an internal skeleton, or an external crust or shell,

muscles to put these bones in motion, and a self-acting cerebral force, as in the brain, ganglia, and cords of the nervous system, to call the muscles into action.

These three systems, which we alone seem at first to recognise when we regard a living animal, which seem to make up the life of the animal, do not digest, respire, or transport about the vital sap or blood that is necessary to their own sustenance. They live not to do these offices, but to connect themselves with the surrounding things of the world. These offices are fulfilled for them by another set of organs, of inferior grade, more approaching in the character of their functions to vegetable life, and though complicate and large in structure, as the stomach, liver, and lungs, have all their acts performed in a series of minute cells.

These nerves, and muscles, and bones are covered without by a condensed cellular tissue, which we call a skin, and which, from exposure to the desiccating effects of the air, becomes hard and scaly.

On the inside, the body is lined, as in the mouth, windpipe, lungs, stomach, and intestines, with an internal integument of an analogous, but softer kind, upon which is thrown the crude substances introduced from without, as the air we breathe, or the food we ingest. This internal integument is infinitely more extensive than the outer, for in the form of ducts or tubes, it is expanded out into a multitude of cells, which form the bulk of the larger as well as the smaller glands. Upon this internal wall of integument or mucous membrane, the initiatory steps of life, the conversion of the food into an animal sap or blood, for the nourishment of the body, is effected.

We have thus an external skin and an internal skin, the two being continuous at the mouth and anus,—the internal doubled as it were within the outer. Now this inversion of one skin within the other, constitutes nearly the entire structure of some of the inferior animals. Many intestinal worms, many polypi, are simple sacs;—they breathe through the outer skin, they digest in the inner.

Animals like fishes, which require the use of a considerable amount of air fixed in the water to purify their blood, have the external skin thrown into plaits, abundantly supplied with blood, to constitute the organs called branchia or gills. The gills of

fishes are nothing but the doublings of the skin, supported on cartilaginous arches. And what are the lungs of the higher air-breathing animals, including man, but an inversion of the outer skin, an immense inversion it is true, expanded into lobes and lobules, and cells, so as to fill a large part of the great cavity of the thorax, and form an extensive surface upon which the external air may be brought in close contiguity to the blood.

The minute pulmonary air-cells, or vesicles, are only closed air-tubes, such as the insect has scattered throughout its whole body; but where there are millions of them, as in man and the larger animals, appended to one stem, or windpipe, we call them lungs. And the ribs, which serve indirectly to keep the lungs extended, may they not be compared to the branchial arches which suspend the gills?

Let us follow out these views further, as regards the comparisons or homologies of structure, between man and other beings, as respects the formation and distribution of the animal sap or blood. In all animals, the food thrown upon the surface of the internal tegumentary membrane, is exposed by a vermicular churning movement of the hollow walls that receive it, to the chemical action of the fluids secreted from the surface of this membrane. A thin fluid made up of primitive globules, the rudimental organic sap or blood, which in man we call chyle, is elaborated from the food on the surface of the intestinal cavity. Now this fluid must be transported, exposed to the air, and distributed to all parts of the animal. It is at the same time formed and taken up by a series of cells which stud the surface of the membrane. In the simple animal, which consists of a double inverted sac with little intervening space, the absorption over so large a surface brings the fluid at once in general contact with the material of their bodies. Nothing like blood-vessels therefore are here needed. But when the body becomes more fleshy, as in the oyster, to these inspiring cells are appended vessels, which distribute the fluid as arteries, and as the fluid, to move freely, requires some additional propelling force, we have the vessels united together, and then expanded into a contractile vesicle, a sort of heart, which beats regularly many times to the minute, and drives its contents about the body at large. When the animal is placed so high in the scale as to require gills, we have a heart with

two cavities added, and when higher still, so as to need lungs, we have a double heart, or an organ with four cavities, two for the body and two for the lungs. This complexity of the heart, requires a modification of the vascular system. The absorbent vessels appended to the chyliferous radicles, which raise the chyle, somewhat as the sap ascends in the vessels of the tree towards the leaves, in order that it may be passed into the heart, and be from thence propelled into the gills or lungs.

For our present purpose, gentlemen, it is not necessary we should carry these comparisons further. My object is merely to show you the tendencies now given to anatomical pursuits, by the learned and the wise in the science. Professor Owen of London is considered as having covered himself with glory, in his recent work on the "Archetype and Homologies of the Vertebrate Skeleton," in which he satisfactorily shows us that the head of a man is composed of the same bones as those of a monkey, a bat, a pigeon, or a fish. And, a still more recent English writer must be considered as entitled to greater praise even than Professor Owen, as he has written a book to show, that considering the sectional structure of the ganglia in the spine and head, man may be cut up into different transverse segments, homological with those of a worm. So you see that by this refined and subtle kind of homological science, man may be considered as constituting at the same time, a beast, a bird, a fish, and a worm, and it should no longer be considered much of a stigma to call him a brute.

I do not mock, gentlemen, at the extension of anatomical science in this direction. I believe it deeply interesting and truly philosophical, when not carried so far as to mar its practical utility by visionary and ridiculous speculation. It seems, however, time almost now to check it with the reins of sober reason, when we find one of the most profoundly learned of the German philosophers thus commenting on a snail.

"Circumspection and foresight appear to be the thoughts of the bivalve mollusca and snails. Gazing upon a snail, one believes that he finds the prophesying goddess, seated upon a tripod. What majesty in a creeping snail, what reflection, what earnestness. What timidity, and yet at the same time what firm confidence. Surely a snail is an exalted symbol of mind slum-

bering deeply within itself." And this I get from page 657 of the great work of Lorenz Oken.

At page 405 he says, "The limbs [of man] are but cervical ribs. The arms are a thorax, consisting quite purely of bone and muscle, and represented as isolated or detached from the viscus or lung; on this depends their nobility, or, in other words, upon what is vegetative having been left wholly behind.

"The arms, when clasped together by the fingers, are a thorax without viscera, without heart and lungs. They are destined to enclose a whole body in their embrace. By an embrace, that which has been embraced, has been made our viscus; it has been adapted as our animal heart, and as our vital animal organ or lung.

"The embrace has an exalted physiological signification, and precisely that, which it unconsciously possesses in the state of *pure love*.

"Nature always thinks more nobly than we do. We follow blindfold her beautiful regulations, and she rejoices in the sport."

But we will not follow Professor Oken further in these far-fetched homologies, which to us, as active, practical men, seem as inanities and foolishness.

We prefer to look at the structure of man, directly in reference to its uses. To carry out a course of anatomical instruction on this basis, in reference to its usefulness to us as physicians and surgeons, to display the parts as they actually exist, and particularize carefully their medical and surgical relations, will be my aim. 'Tis not the course commonly pursued, but 'tis the one which I feel impelled to pursue, by a sense of duty to you as your teacher, inasmuch as it makes the subject more plain and easy, and is in full accordance with the practical tendency of the times.

The science, however, that you are to learn, is in itself so extensive as to require close and intelligent attention on your part, comprising, as it does, the whole anatomy of man, with all its great variations at his different epochs of life. And upon it is founded all that we know, all that we may expect to acquire of excellence in our profession. It is the basis structure of both medicine and surgery.

Man is, of all animals, in his infantile state, the most helpless and unprotected.

The insect at its birth comes forth armed even with instruments of defence, and is provided with a marvellous internal instinct, sufficient for its self-preservation. The young of birds and quadrupeds are in a few weeks cast off, capable of procuring their own support. Neither lizards or the fishes, with scarcely an exception, receive the slightest parental protection from the period of their birth. To all these fair Nature is the kindest mother still. She clothes each animal after its kind, with hair, with feathers, or with scales, strengthens their steps and directs their instincts, endows them with the instruments of motion most appropriate to their sphere, or, if needs be, changes or metamorphoses them, according as they are to live in the air or on the water, upon the foliage of plants or the nectareous sweetness of the flowers.

Man alone comes utterly naked and helpless from his mother's womb, with a head so large that its own muscles cannot lift it, limbs so feeble that they offer no support, with a brain so soft that it is nearly destitute of functions, and liable from the instant to a crowd of diseases peculiar to the race; bereft, as it were, of every endowment but that of sensibility to pain, hunger, and thirst; requiring to be clothed, and watched, and fed, and needing, in the many diseases which occur during his slow progress towards adolescence, the fostering care of a physician, who shall be thoroughly familiar with his varying organizations and his wants.

He grows up into manhood, and we now find him the master of the earth—not by any superiority as regards physical force or rapidity of movement, but through the instrumentality of a larger brain and a peculiar mental endowment.

The large development and tender texture of the brain, which was the great cause of his helpless feebleness in infancy, has now become the source of his almost godlike power. The very protraction of that infancy has proved one of the chief means of his strength, as it has rendered him docile to instruction, and enabled him to acquire the treasures of education.

His natural nakedness has led him to the invention of the

spinning-jenny and the loom. His social wants have built up cities. His refined and delicate appetite has induced him to cultivate the earth, till he has made the wilderness to blossom as the rose.

His relative physical incapacity has caused him to employ the powers of steam, that he may move with a swiftness scarcely excelled by the eagle in its flight, and to devise an imitation of Jove's red artillery, by which the lion, the tiger, and the elephant are vanquished at a distance by the slightest movement of his finger. His deficiency in that fine instinct, which leads so unerringly birds, beasts, and fishes in their periodical migrations, has caused him to devise the compass, and to watch the stars, to provide himself with guides, by which he may traverse the whole earth at will, and inspect its brute inhabitants as a master would his possessions and his slaves.

He extends his conquests over the earth, but it is not to destroy—it is to beautify and adorn it. The nice refinement of his senses leads him to provide for even more than physical wants. The very elements, simple in themselves, are made by the illusions of his fancy to wear a shape and form more agreeable to his imagination. He animates with a spirit the tree which covers him with its branches; he hears a gentle voice speaking in the zephyr, a plaintive murmur in the rivulet, a furious genius in the storm, and a speaking being in the echo of the mountain side.

Filled to the full with this multiplication of enjoyments, and satiated with power, he advances, till with years there comes, sooner or later, according to the natural strength or feebleness of his constitution, or the medical skill with which it has been guarded against the results of accident and disease, the second childhood of age, the final change to the scene. The senses, one by one, become dulled and extinguished; the right arm gradually forgets its cunning; the bones become fragile and unresisting, the joints stiff and unyielding, and he falls, bent with years and wasted with exertion, almost unresistingly into the tomb.

But man does not achieve these feats of invention and conquest but by a perpetual and dangerous tension of the springs of

mental and vital power, which may at any moment snap asunder, and at an accumulating risk of danger and death, which may prostrate him before his natural appointed course is run.

Thousands of our fellow-beings happily and honourably devote themselves to the invention, and the construction, and the working of artistical machinery, made up of wood, and iron, and brass. How low and grovelling is such an occupation compared with yours.

You have a machine laid before you, for investigation and management, more perfect in its construction, in relation to the uses for which it is designed, than anything that has ever entered into the heart of man to wish for, or the mind of man to conceive; a machine, moreover, of God's own construction, and made to serve as the habitation of that divine essence which was breathed into it with the breath of life, and which is held in durance for a while in the material body.

Of the truth of the fact of this embodiment of the spirit in our material frame, all science, reason, and religion speak.

I shall shortly show you the mighty instrument, the so-called immediate agent of man's greatness upon earth—his own right arm—stripped of its coverings, so as to reveal the beautiful and complex machinery which controlled its movements. You will see the muscles and the tapering tendons, with which each digit is supplied; the blood-vessels, which maintained its life, and the nerves which endowed it with sensibility, and placed it under the dominion of the will.

The machinery will be complete, but it will no longer work. And if we look to the part from whence the governing powers came, we shall find it in the cerebral mass, carefully packed away in the cavity of this hollow bone, the skull.

Yet this mass, soon as the spirit leaves it, is an inert and useless structure; compounded merely of the commonest elements, which the chemist is able to extract and almost recombine at will, and soon drops into nothingness, when

> "Reft of its carnal life save what shall be
> Existent happier in the fly and worm,"

while the spirit has gone to God, who gave it. This bony case, though more enduring, this earthly covering to the brain, what

is it now, more than a wasted useless piece of pottery, slowly mouldering to decay. Yet it once contained a royal lodger.

"Look at its ruined arch, its broken wall,
Its chambers desolate, and portals foul:
Yet this was once ambition's airy hall,
Dome of the thought, and palace of the soul.
Behold, through each lack-lustre eyeless hole,
The gay recess of wisdom and of wit,
And passion's host that never brooked control;
Can all that saint, sage, sophist ever writ,
People this lonely tower, this tenement refit?"

Man then, this august minister of nature, this mighty ruler of the dominions of the earth, whose power exists only when his bodily structure is unimpaired, who achieves no conquests, but at the constant risk of dissolution, with all his ailments and his wants, his weaknesses and his powers, is the great machine which is to be hereafter, the lofty theme for your unceasing observation by day, and your contemplation by night. For his benefit you are for the future bound to exert all your abilities, to soothe his distresses, avert and cure his diseases, and in this way lengthen out his span, by preserving to the longest limit possible this earthly tabernacle as a fit occupancy for the noble tenant lodged within.

Possessed with an aim so lofty as this, it is impossible for you to measure the dignity or the extent of the usefulness of our profession, which, when conjoined with that of the ministers of our holy religion, form really the two only indispensable requisites for the complete fulfilment of man's destiny upon earth.

Strive, then, I entreat you, one and all of you, now while the opportunity is afforded you, and your teachers are standing anxiously by your side, athirst with desire to promote your present and future professional welfare,—strive, I entreat you, so to qualify yourselves for your important duties, that your great vocation may never be exercised amiss. Stop not in your exertions, even if you should be so fortunate as to reach the topmost round in the ladder of ambition, and remember now, while you are laying the foundations broad and deep for a life of usefulness and honour, that

"Better than fame, is still the toil for fame,
The constant training for the glorious strife."